ABSTRACT

A variable astigmatic focal beam spot is formed using lasers with an anamorphic beam delivery system. The variable astigmatic focal beam spot can be used for cutting applications, for example, to scribe semiconductor wafers such as light emitting diode (LED) wafers. The exemplary anamorphic beam delivery system comprises a series of optical components, which deliberately introduce astigmatism to produce focal points separated into two principal meridians, i.e. vertical and horizontal. The astigmatic focal points result in an asymmetric, yet sharply focused, beam spot that consists of sharpened leading and trailing edges. Adjusting the astigmatic focal points changes the aspect ratio of the compressed focal beam spot, allowing adjustment of energy density at the target without affecting laser output power. Scribing wafers with properly optimized energy and power density increases scribing speeds while minimizing excessive heating and collateral material damage.